

ECOCARE: sustainable design for absorbent hygiene

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The most urgent environmental challenges related to the absorbent hygiene product category are resource consumption, CO₂ emission, transport processes, waste management and lack of circular economy of materials. The EcoCare project aims to demonstrate environmental and technological improvements achieved by an innovative absorbent structure and sustainable materials for baby diapers and menstrual absorbent hygiene products.

Several European Union environmental sustainability policies and regulations have been developed in the last decade, such as the EU climate policy and the White Paper on Transport 2011, the 7th Environment Action Programme and the Roadmap for a Resource-Efficient Europe, the revised Waste Framework Directive (2018/851) and the revised Landfill Directive (EU 2018/850). Lately, the EU Directive on Single-Use Plastics (EU 2019/904) has reached the phase of application in the member states in July 2021.

EU research programmes call for institutes and industry to address these challenges. Procter & Gamble (P&G) applied for a grant in 2014 ("CELSTAB") (P&G, no date-a) and 2019 ("EcoCare") (P&G, no date-b) and is working on research co-funded by the LIFE+ Programme, the EU funding scheme for environmental, nature conservation and climate action projects. CELSTAB closed in December 2018 with the successful development of an innovative multilayer absorbent core structure for sanitary napkins with an improved environmental profile. EcoCare

is a current three-year project (Aug 2019 – Jul 2022) to demonstrate further reduction of the environmental impact of absorbent hygiene products (AHP) using sustainable eco-technology.

For decades, environmental sustainability has been embedded in how P&G does business (P&G, no date-c; no date-d). Since 2010, P&G has doubled the use of recycled plastic resin, reduced its greenhouse gas (GHG) emissions by 52 per cent, reached 'zero manufacturing waste to landfill' and purchased 97 per cent renewable electricity across all production sites globally. In September 2021, P&G set a new ambition to achieve 'net zero' GHG emissions across its operations and supply chain by 2040, from raw material to retailer (P&G, 2021-c).

P&G produces a huge portfolio of AHP (P&G, no date-e), including single-use baby diapers, sanitary napkins, pantyliners and tampons. In the P&G Innovation Centre in Schwalbach, Germany, research groups are enhancing the absorbent system of baby diapers

and sanitary napkins. P&G research and development activities have led to several new patented applications with the potential to substantially reduce waste and improve environmental performance.

How can sustainability be designed into absorbent hygiene products?

Single-use diapers and sanitary pads or pantyliners consist mainly of:

- top and intermediate layers of synthetic or nature-derived materials (such as polyethylene, polyester or polypropylene, or viscose or cotton),
- an internal absorbent core of cellulose fluff with or without polyacrylate super-absorber (SAP), and
- a watertight bottom layer (EDANA 2019a; 2019b; no date-a-d).

Past experiments to develop industrially biodegradable absorbent devices (paper- or cotton-based) for the hygiene sector have not been commercially successful. Reasons for this include a lack of comfort,

efficacy, and difficulty in producing the products in the high quantities required. Also, especially in the case of menstrual protection products, hygiene considerations preclude public collection and disposal via biodegradation or recycling.

Reducing the environmental impact (related to resource consumption, transport, and packaging) must not jeopardise product safety and technological performance. This complex task requires research teams to analyse and consider the tradeoffs of different materials, processes, and end-of-life solutions, with no difference for re-usable or single-use products.

With EcoCare and its precursor project CELSTAB, a step-by-step approach to increasing the sustainability of single-use products has been chosen, accompanied by intensive consumer testing for product comfort and efficacy.

The objective, to reduce environmental impacts of AHP with the new eco-design, is approached in three areas:

- Material reduction (core, lofted fibres = CELSTAB eco-design)
 - Integration of new sustainable materials into products (bio-based, from renewable resources, recycled)
 - Supplier localisation (EU-based).
- The EcoCare project has different product paths: baby diapers, pantyliners and tampons.

Building on the success of CELSTAB with improved sustainability of sanitary napkins, EcoCare applies the enhanced multilayer absorbent system from CELSTAB in baby diapers and pantyliners. Consumer testing was designed to assess if this reapplication of the CELSTAB concept can meet consumer quality demands, industrial-scale production requirements and preserve a reasonable cost/ benefit ratio.

Additionally, the team works on further increasing the sustainability of baby diapers, pantyliners and tampons. This goal is approached by using new sustainable materials and/or reducing plastic content while preserving good quality and high performance

to sustain consumer satisfaction. Exploratory sustainable materials can be based on cotton, cellulose, corn, bio-superabsorber, bio-films, bio-PE/PP nonwovens, and other feedstock. Their advantage is reducing the consumption of non-renewable fossil resources and increasing sustainable resources.

The EcoCare project success targets (see Figure 1) are based on the results achieved with CELSTAB in 2018 (P&G, no date-a) and will further increase the sustainability of the products:

- 10-25 per cent reduction of raw material input per AHP product
- 10-25 per cent waste prevention at the end of the product's life
- 5-15 per cent reduction of GHG emission by mass reduction, usage of sustainable materials, reduced landfill and transport reduction
- Reduction of non-renewable resource consumption and increasing sustainable resources: up to 50 per cent in baby diapers and over 75 per cent in menstrual protection.

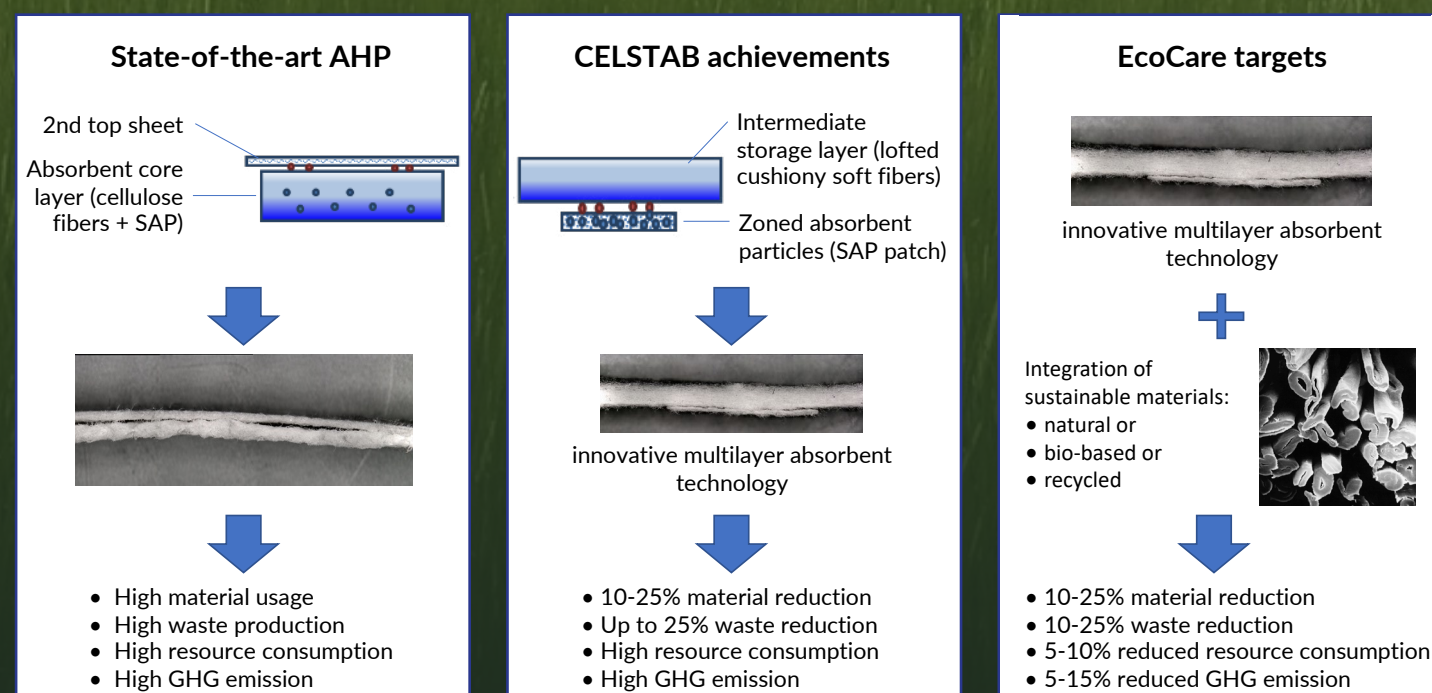


Figure 1: (Left) State-of-the-art AHP illustration and benefits. (Centre) CELSTAB project's product illustration and achievements. (Right) EcoCare project targets.



Figure 2: New diaper prototype (right) against reference (left) showing product mass reduction with comparable performance and protection.

Mid-term progress

EcoCare reached the mid-term stage in August 2021. The initial results show that the sustainably designed AHPs (pantyliner, tampon and diapers) have the potential to meet the project targets.


- The CELSTAB project achieved a prototype for menstrual protection sanitary napkins. For EcoCare, additional prototypes for pantyliners and baby diapers could successfully be produced with the innovative absorbent structure, reduced and sustainable material input.
- The new product designs for pantyliners and baby diapers with a material mass reduction within the targeted range have been successfully tested with consumers (Figure 2).

The EcoCare project team will continue to explore sustainable materials for the current prototypes, test performance and consumer feedback. The products will be optimised step-by-step. Final targets achieved will be verified via the development of environmental impact assessments and/or life cycle assessments (LCAs).

The project contributes to a more efficient management of raw material resources and prevention of waste related to menstrual protection products and baby diapers. It will also lead to reduced waste amounts brought to incineration and landfill.

The end goal is to provide better performing and more sustainable products to consumers, considering the whole product life cycle and European infrastructure.



 References [click here](#)

PROJECT SUMMARY

The LIFE EcoCare project explores new sustainable material alternatives for absorbent hygiene products (AHP) such as baby diapers, pantyliners and tampons. The research team looks into renewable and recycled resources, for example, cotton, cellulose, corn, bio-SAP, bio-films, bio PE/PP nonwovens and bio-based naphtha, including EU locally-sourced fibres. The applied innovative multilayer absorbent technology considerably reduces the material and volume.

PROJECT LEAD

The Procter & Gamble Company (P&G) was founded in 1837. Today P&G is a multinational consumer goods corporation with a huge portfolio of hygiene and household brands in more than 180 countries. P&G set the sustainability ambition for 2040 to achieve net zero greenhouse gas emissions across its operations and supply chain, including interim 2030 goals for progress in this decade.

P&G is aware of its responsibility as a driving force of innovation in the AHP sector. In the P&G Innovation Centre in Schwalbach, Germany, research groups are enhancing the absorbent system of baby diapers and menstrual protection. P&G research and development activities have led to several new patented applications that have the potential to substantially reduce waste and improve environmental performance.

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